A Digital Medical Splint for Distal Radius Fractures

Supervisor: Jie Sun
Authors: Xuanming Miao (2254774) Xinyi Liu (2253139)

User Needs and Design Requirement

Traditional Chinese Medicine (TCM) splints drawbacks

- lack real-time feedback

Patients

- Improved comfort and safety

Clinicians

- **Remote monitoring** to support follow-up care
- Accurate monitoring of **tightness**
- Real-time **temperature & humidity** data

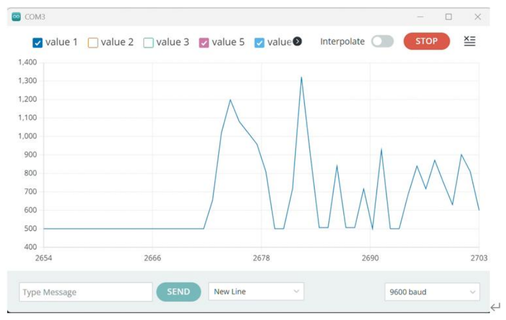
Our digital splint **addresses** these by integrating sensors and wireless transmission, **enhancing** traditional therapy with intelligent feedback.

Sensor Performance Comparison:

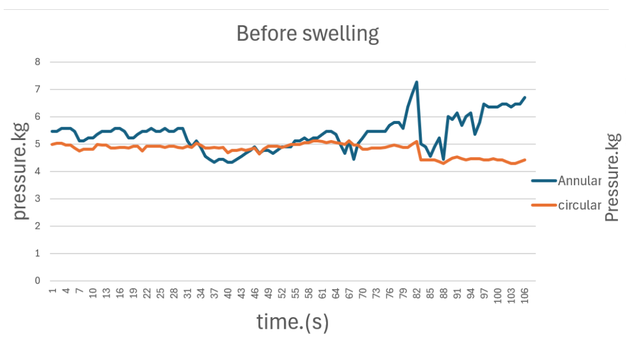
Legacy Design:

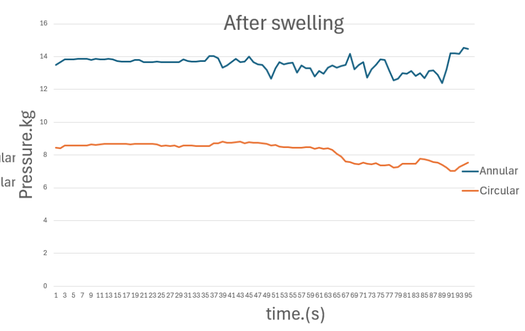
- Instability
- Fluctuation

- 40mm*40mm square thin-film pressure sensor with measuring range: 500g-20kg.



Enhanced Designs:





Design Features

- Dual pressure sensors (circular & annular)
- Magnitude of pressure → Swelling condition
- Timed measurement and low-power mode

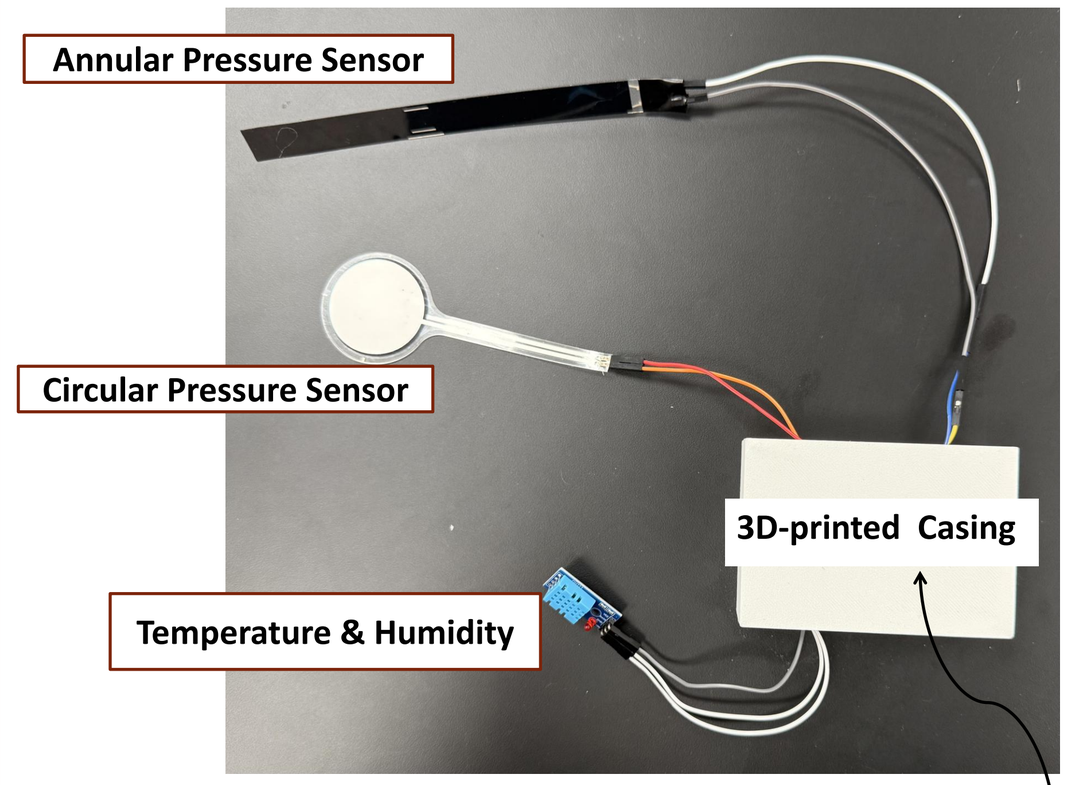
Contribution

Student Name/ID	Contribution percentage (100% in total)	Brief description of individual contribution
Xinyi Liu/2253139	25%	Group leader.Decision Making.
Xuanming Miao/2254774	25%	Hardware simulation and soldering.
Yiheng Ren/2251548	25%	Circuit and sensors design and programing.
Yuan Zhuang/2257580	25%	Design the enclosure.

Hardware and Software Function

Hardware composition

- Arduino Nano
- Circular pressure sensor
- Annular pressure sensor
- Buletooth
- Temperature & humidity sensor



The sensors are embedded inside a **3D-printed casing**

Software function

- Measure datas - 10 min/3h
- Data transmission

```
void takeReadings() {
  // Get the current timestamp
  String currentTime = getElapsedTime();

  // Read pressure sensor values
  int stripPressureRaw = analogRead(STRIP_PRESSURE_SENSOR_PIN);
  int roundPressureRaw = analogRead(ROUND_PRESSURE_SENSOR_PIN);

  // Read temperature and humidity
  float humidity = dht.readHumidity();
  float temperature = dht.readTemperature();
```

Bluetooth inside

User Testing and Feedback

- Circular sensor: size appropriate for wrist use
- Comfortable when placed over cotton padding
- No significant signal loss through cotton
- Temperature, humidity, and swelling changes detected reliably

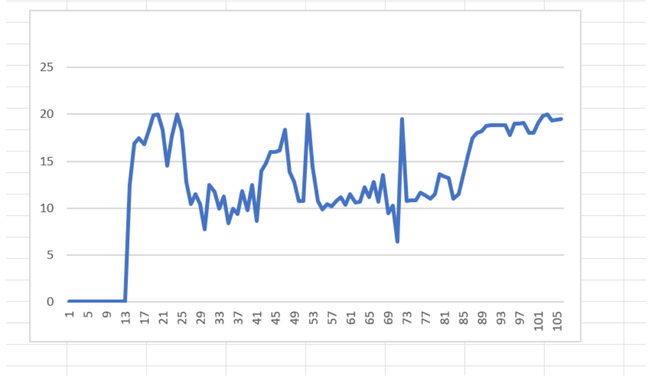
Conclusion and Future Work

Conclusion

- Multi-sensor detection & Data transmission

Following improvements

- Data processing and handling
- Replace with rechargeable batteries
- Use PCB to reduce space



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